Traumatic Hemopneumothorax in the Minor Pulmonary Fissure

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• **Traumatic rupture of the visceral pleura lining the minor pulmonary fissure may produce encapsulated hemopneumothorax limited to the space between the right upper and middle lobes.**

This lesion, which may persist for several weeks, may be differentiated from cystic pulmonary lesions and from lung abscess by its radiologically demonstrated constant and intimate symmetrical relation to the plane of the minor fissure.

THE OCCURRENCE of isolated collections of fluid or blood in the interlobar pulmonary fissures is well known.[2-6] The principles of radiologic differentiation of these interlobar collections from the intrapulmonary lesions they so often simulate have been well worked out and are now generally recognized.[2,7] When the fluid is limited to the minor fissure, differentiation from parenchymal lesions of adjacent segments of the middle and upper lobe may be troublesome, but with the aid of fluoroscopically-selected oblique views, and laminagraphy, the differentiation can usually be made.

However, the occurrence of a related and equally deceptive lesion, hemopneumothorax in the minor fissure, the result of trauma, has not been generally recognized and so far as could be determined, has not been described previously. It is the purpose of this paper to report three cases of such lesions and to enumerate the features by which the condition may be differentiated from lung abscess and from communicating lung cyst.

CLINICAL FEATURES

The three patients were young men, ages 21 to 30, each of whom incurred, in an automobile accident, a chest injury severe enough to fracture one or more of the upper four ribs. In two, the rib fractures were on the right, but in the third, the rib fractures were on the left side only. Two of the patients had immediate hemoptysis, and two showed subcutaneous emphysema. One had associated right general pneumothorax and pleural effusion, while the patient with the rib fractures on the left side had general pneumothorax on that side.

In each patient, an x-ray film of the chest, taken from one and one-half hours to three days after injury, showed an oval lesion, with air-fluid level, deep in the midportion of the right lung field.

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REPORTS OF CASES

CASE 1. A 30-year-old dentist with no previous history of chest disease was struck on the chest in an automobile accident. He promptly coughed blood, and felt severe inspiratory chest pain. Survey x-ray films one and one-half hours after injury showed an oval cavity, interpreted as a "lung cyst" with fluid and gas, in the right midlung field.

More complete x-ray studies four days later (Herrick Memorial Hospital) showed minute fractures of the right third and fourth ribs, and separation of the right first costochondral junction. A 2 × 6 cm. oval lesion (Figure 1) containing air and fluid was seen in the right midlung field. The posterior borders of the lesion coincided exactly with the position of the posterior portion of the minor pulmonary fissure as shown on the routine lateral films of the chest taken previously. Fluoroscopy showed the fluid freely movable within the cavity. Lateral laminagrams showed the lesion merging anteriorly into the line of the minor pulmonary fissure; posteriorly, by a small dense triangle, into the junction of minor and major fissures (Figure 2).

Two weeks after injury the fluid had almost disappeared and the cavity had shrunk to a 2 cm. gas pocket. After one month, there was only a residual slight thickening of the minor fissure. At last report patient was well and working.

CASE 2. A 21-year-old mechanic, with no history of previous chest disease, fell out of a truck as it turned over, breaking his left scapula and clavicle and the top three ribs on the left. The patient, when questioned later, did not recall spitting blood, but he had been briefly unconscious. X-ray films taken shortly after the injury showed left pneumothorax and left subcutaneous emphysema, but no right pneumothorax or fluid was noted (films not available for review). Three days after injury, a cavity

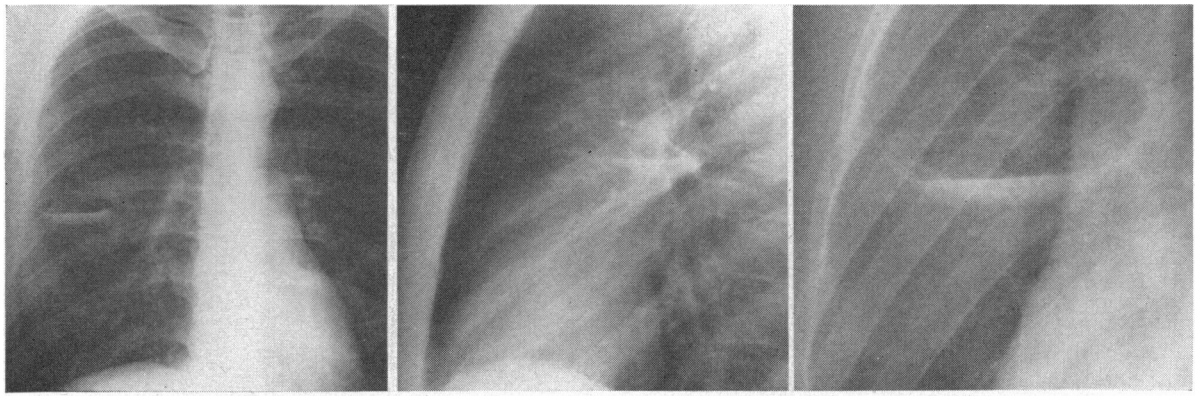

Figure 1 (Case 1).—Upright films of the chest, four days after injury, showing the air-and-fluid collection in the minor interlobar fissure. *Left:* Postero-anterior projection. *Center:* Right lateral projection. *Right:* Left anterior oblique projection (Bucky) of right midlung field.

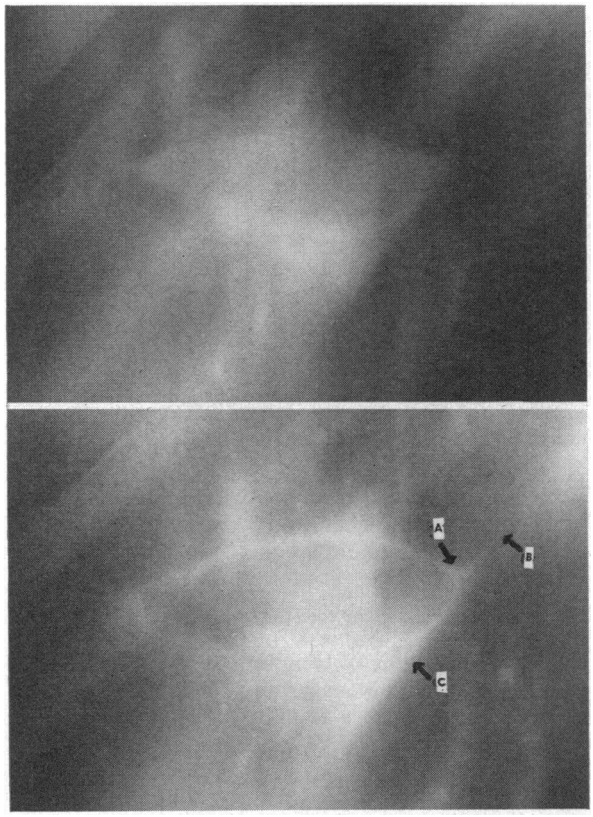

Figure 2 (Case 1).—Lateral laminagrams, right decubitus of right midlung field five days after injury. Note the triangular density posteriorly as the lesion reaches the major interlobar fissure. *Above:* Section taken below fluid level. *Below:* Section taken just above fluid level, in air-containing portion of lesion. Arrow *A* points to triangular density. Arrows *B* and *C* point to major interlobar fissure.

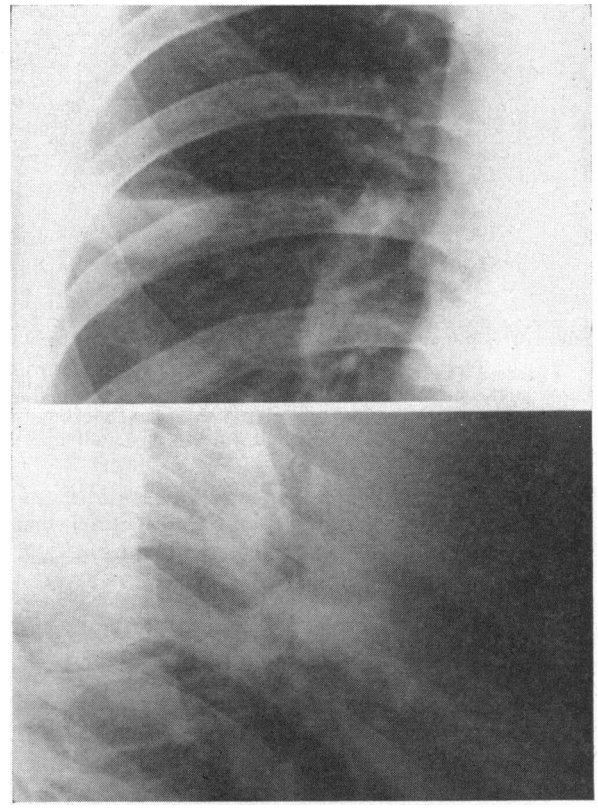

Figure 3 (Case 2).—Upright films of the right midlung field, 16 days after injury, showing air-fluid collection in the minor interlobar fissure. *Above:* Postero-anterior projection. *Below:* Lateral projection.

was seen in the right lung field and the patient was admitted to Peralta Hospital with a provisional diagnosis of "lung abscess."

Figure 3, taken ten days after injury, shows the fluid collection with the air bubble above it; it measured 7 cm. in the lateral view but only 4.5 cm. in the postero-anterior projection. In the lateral view, the lesion blended into the posterior end of the minor fissure by a small dense triangle. Repeated attempts at bronchoscopic aspiration failed to empty the cavity. On the 27th day, needle aspiration through the chest wall was carried out under fluoroscopic guidance and 5 cc. of bloody fluid and gas was withdrawn. Films taken immediately afterward showed the lesion much smaller. The patient was

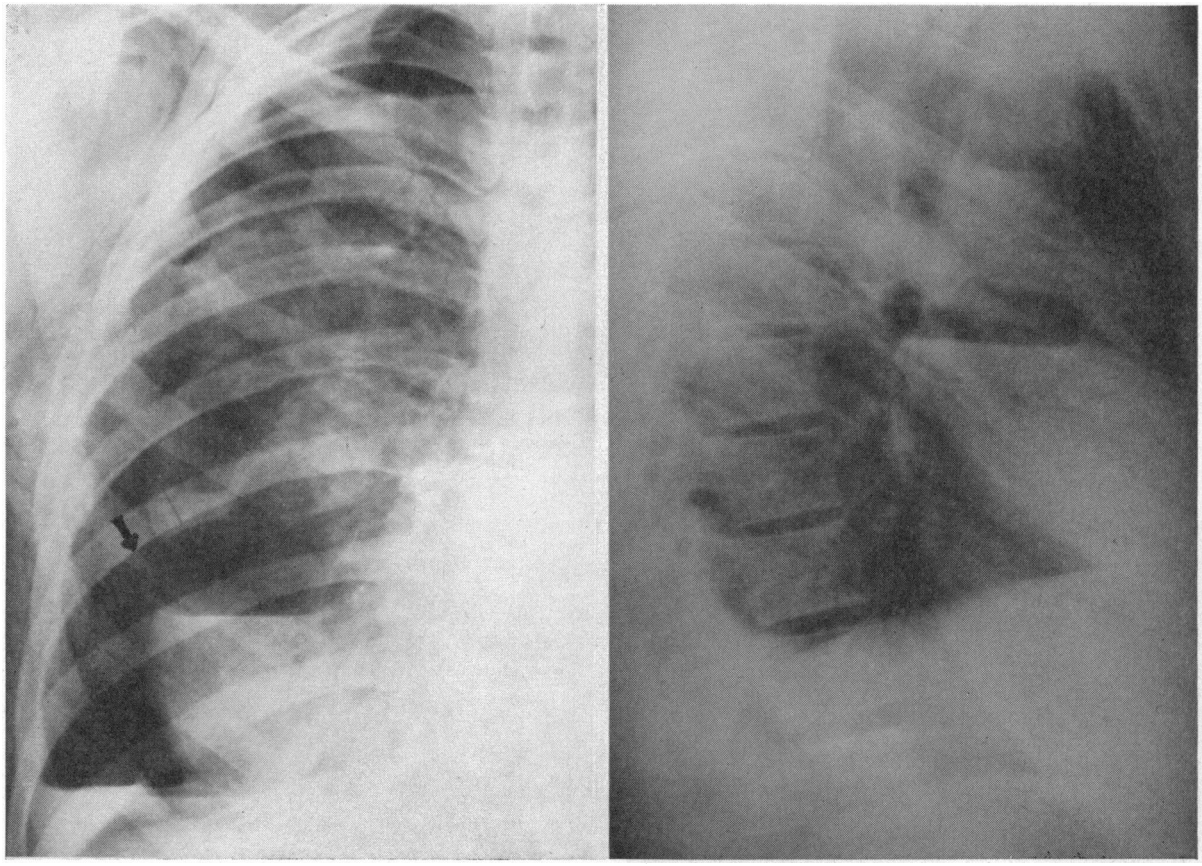

Figure 4 (Case 3).—*Left:* Upright film of the right hemithorax one day after injury, showing air-and-fluid collection in the minor interlobar fissure, air and fluid in the right pleural cavity, and interstitial emphysema of chest wall and axilla. Arrow points to bulging thin line, presumably visceral pleura. *Right:* Upright right lateral projection, one day after injury, showing air and fluid in minor fissure and smaller collection of air and fluid above.

discharged on the 30th day. Seven weeks after injury, fluoroscopy showed only some thickened pleura. Thereafter the patient was well and working.

CASE 3. A 21-year-old hospital orderly with no previous history of chest disease struck the right side of his chest against the steering wheel in an automobile accident. There was prompt hemoptysis. On admission of the patient to San Francisco Hospital, x-ray films taken 11 hours after injury showed fractures of the right first to fourth ribs, subcutaneous emphysema and right pneumothorax with a small collection of fluid over the diaphragm. An additional air-fluid level, 6 cm. in length in the posteroanterior view, occupied the position of the posterior portion of the minor fissure and reached the visceral pleura laterally. There a thin curved hair-line density, bulging laterally into the general pneumothorax space, apparently was the visceral pleura layer (Figure 4, *left*). In the lateral view, the characteristic dense posterior triangle was formed as the converging surfaces of the minor fissure joined the major fissure (Figure 4, *right*). An additional small fluid level, 6 cm. higher, probably represented a pool of fluid or blood caught on a band of pleural adhesions. Upon thoracentesis on the fourth day 550 cc. of bloody fluid and 450 cc. of gas were removed. The patient was discharged on the tenth day. In six weeks the pneumothorax had almost completely disappeared.

PATHOGENESIS

The pathogenesis of the minor fissure hemopneumothorax, in the absence of a surgically-explored patient, must remain speculative. As distinct from many kinds of general pneumothorax this lesion cannot be ascribed to perforation of the visceral pleura by a jagged end of a fractured rib. In one of the three patients, herein reported upon, there were no rib fractures on the right side, and in the other two the rib fractures did not reach as low as the level of the minor fissure. One would be led to postulate, instead, that the lesion arose from a bursting or tearing of the visceral pleura lining the minor fissure, with escape of air and blood into the minor fissure space. In discussing the mode of development of interlobar effusion, Rigler[6] noted that a similar method, direct extension from the lung parenchyma through the visceral pleura lining the fissure, occurs in some inflammatory processes.

The subsequent persistence of the limitation of the air-and-blood collection to the minor fissure, without escape into the general pleural cavity, must be owing to previous peripheral sealing. Inflammatory sealing of the edges of the minor fissure (as may have occurred in Case 3 herein reported) must be relatively rare. However, in routine postmortem examinations, it is not uncommon to find an obliteration of the general pleural cavity which has not extended deep into the minor fissure, thus leaving the fissure as a free potential space.[1] Such a mechanism may well be the explanation of the limitation of the air-fluid collection to the minor fissure in Cases 1 and 2. If this explanation is correct, one would predict that similar traumatic air-and-fluid collections may be found in other fissures as well.

DIAGNOSIS

This lesion has shown itself to represent a diagnostic pitfall. In Case 1, the patient was presented with a previous x-ray impression of "lung cyst"; in Case 2, the patient was presented as having a "lung abscess." Factors which may lead to diagnostic error include, first, unfamiliarity with the existence of the lesion. The occurrence of an air-fluid level deep in the lung substance, apparently surrounded on all sides by lung parenchyma, and the localization to the posterior portion of the fissure, which extends well posterior to the hilum, also tend to confuse the picture. Finally, the persistence of the lesion over several weeks in relatively stable form increases the possibility of misinterpretation.

Once the lesion has been thought of, the diagnosis is relatively simple. The history of recent chest injury, perhaps with hemoptysis or rib fracture, followed by the discovery of an oval or spindle-shaped air-fluid collection in the plane of the minor fissure, should lead to careful examination of the relation of the edges of the lesion to the recognizable position, if any, of the minor fissure. Two details of the appearance of the borders may be helpful. First, the posterior extremity of the lesion, in the lateral view, consists of a small dense triangle, symmetrically placed on and merging into, the posterior extremity of the minor fissure, at its junction with the major pulmonary fissure. Anteriorly, the lesion merges into the minor fissure by a long pointed lanceolate density. Second, the sharp outline of the gas-pleural surface superiorly contrasts with the hazy merging of the lower border of the fluid collection with the compressed or contused lung immediately below. Laminagraphy is helpful in showing some detail, but conventional views well exposed are likely to afford sufficient detail for diagnosis.

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REFERENCES

1. Fishback, H. R.: Personal communication.

2. Fleischner, F.: Das Röntgenbild der interlobären Pleuritis und seine Differentialdiagnose, Ergebn. d. med. Strahlenforsch, 2:197-248, 1926.

3. Freedman, E.: Roentgenological appearance of interlobar and mediastinal encapsulated effusions in the thorax, Radiol., 16:14-29, Jan. 1931.

4. Gefter, W. I., Boucot, K. R., and Marshall, E. W.: Localized interlobar effusion in congestive heart failure, Circulation, 2:336-343, Sept. 1950.

5. Katz, S., and Reed, H. R.: Unusual pleural effusions, Radiol., 45:147-155, 1945.

6. Rigler, L. G.: A roentgen study of the mode of development of interlobar effusions, J. Thorac. Surg., 5:295-304, Feb. 1936.

7. Robbins, L. L., and Hale, C. H.: The roentgen appearance of lobar and segmental collapse of the lung. IV. Collapse of the lower lobes, Radiol., 45:120-127, 1945. Collapse of the right middle lobe, Radiol., 45:260-266, 1945.